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| **Title and Code** of the subject:**Nutritional genetics and genomics, MTMEL7037A** | **ECTS Credit Points: 4** |
| **Type** of the subject: optional  |
| **Ratio of theory and practice: 50/50** (credit%) |
| **Type and number of classes per semester**:28 hour(s) lecture and28 hour(s) practice per **semester** Number of teaching hours / week : 2+2 (lecture and practice) |
| **Type of exam**: exam  |
| **Subject in the curriculum:** semester 3. |
| Preliminary requirements: *Nutritional Sciences, Essentials of Molecular Cell Biology, Healthy nutrition* |

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| **Summary of content - theory**: • Students will understand the correlation between genomes and environmental factors that facilitate every vital phenomena, and nutrition will be regarded as one of the most important environmental factors, influencing the general health condition of humans. • Students will be acquainted with the main trends nutritional genetic and genomic trends regarding the innovative food development with respect to personalized preventive and /or therapeutic nutrition. |
| Course objectives:1. Nutritional genetics and genomics. Concepts, research tools and expectations.2. Epigenetics. Molecular targets for diet and chronic disease prevention. Diet influenced chromatin modifications and expression of chemopreventive genes.3-4. Nuclear receptors and signal transduction pathways regulating gene expression.5. Nuclear receptors and the control of gene expression by fatty acids. 6. PPARs regulated cell differentiation processes.7. Amino acid availability and gene expression regulation.8. Transcriptional regulation of hepatic genes by insulin and glucose.9. PPARs in atherosclerosis.10. PPAR implication in diabetes and metabolic syndrome.11. Regulation of lipogenic genes in obesity.12. Nutrition and inflammatory response.13. Genetic polymorphism, nutrition and hypertension.14. Genetic polymorphism, nutrition and cancer. |
| **Summary of content - practice**:Student will carry out some experiments in order to study the influence of nutrition on animal experimental models. They will learn about the experiments meant to detect the induced mutagenic effect.  |
| 1-2. *Drosophila melanogaster* as a nutritional genetic research model system. 3-4. Studying plant extracts chromatin organization modifier effects5-6. Evaluation of mutagenic effect using somatic mutation and recombination test. 7-8. Evaluation of Keap1/Nrf2/ARE mediated xenobiotic response induced by plant extracts. 9-10. Animal models for studying the metabolic syndrome. 11-12. Elaboration of a nutritional genetic and genomic research project to study a food prototype. 13-14. Product concept presentation and evaluation. |
| **Literature, handbooks in English**  |
| • Aggarwal, B.B., Heber, D. (2014). Immunonutrition: Interactions of Diet, Genetics, and Inflammation. CRC Press, ISBN: 9781466503854.• Bidlack, WR, Rodrigez, RL. (2012). Nutritional Genomics. The impact of dietary regulation of gene function on human disease. CRC Press, Taylor & Francis Group, Boca Raton, London, New York, ISBN: 978-1-4398-4452-6. • Brigelius-Flohé R and Joost H-G. (2006). Nutritional Genomics. Impact on Health and Disease. Whiley-VCH Verlag GmbH&Co. KGaA. ISBN-10: 3-527-31294-3 • Graham, G., Kesten, D., Scherwitz, L. (2011). Pottenger's Prophecy: How Food Resets Genes for Wellness or Illness. ISBN: 978-1-935052.• Kohlmeier, M. (2012). Nutrigenetics Applying the Science of Personal Nutrition. Academic Press. ISBN: 978-0-12-385900-6• Lanham-New, S.A., Macdonald, I.A., Roche, H.M. (2010). Nutrition and Metabolism, 2nd Edition. Wiley-Blackwell. ISBN: 978-1-4051-6808-3• Shanahan, C. and Shanahan, L. (2008). Deep Nutrition: Why Your Genes Need Traditional Food. ISBN-10: 0-615-22838-0.• PUBMED database /Books:- Pagon RA, Adam MP, Ardinger HH, et al., editors. (1993-2014). GeneReviews® [Internet]. Seattle (WA): University of Washington, Seattle; 1993-2014.- Making Sense of Your Genes: A Guide to Genetic Counselling. National Society of Genetic Counselors; Genetic Alliance. Washington (DC): Genetic Alliance; 2008.- Integrating Large-Scale Genomic Information into Clinical Practice: Workshop Summary. Institute of Medicine (US). Washington (DC): National Academies Press (US); 2012.- Benzie I.F.F. and Wachtel-Galor, S. (2011). Herbal Medicine, 2nd edition. CRC Press; ISBN-13: 978-1-4398-0713-2 |
| **Competencies gained** *(acc. to the Regulation on training and outcome requirements)* |
| 1. **Knowledge:**
* The organization levels of living material, and the system theory based interpretation of vital phenomena.
* The pro- and eukaryotic cells structural and functional properties. The nutrition, respiration, metabolism, growth, division and death of cells.
* Multiple correlations between cellular phenomena and nutrition: the reciprocity of genetic and environmental regulation, cell cycle and redox potential regulation, signal transduction and gene expression, cellular homeostasis.
* Multiple correlations regarding multicellular individuals and nutrition: differentiation and integration, neuronal and hormonal regulation, epigenetic control, ageing, nutritional value and bioavailability.
1. **Skills:**
* Capable of assessing the molecular aspects of health and nutrition, together with the molecular features of hazards to food chain.
* Students will acquire knowledge to work in a molecular laboratory.
1. **Attitude:**
* Students will become aware of the importance of personalized nutrition that is based on specific correlations between the individual characteristics of genomes and nutritional/energetic/bioactive compounds statuses, and all together standing at the basis of novel food development strategies
* Committed to food R & D & I activities
1. **Autonomy and responsibility:**
* Committed to food quality, safety, and environmental friendly and sustainable solutions that support the health of the individuals, the society and bioeconomy.
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| **Responsible lecturer: Dr. Endre Máthé PhD** |
| **Other lecturer(s): -** |

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| **Terms of course completion:** |
| 2 essays on given topic |
| **Form of examination:** |
| Written and oral exam |
| **Requirement(s) to get signature:** |
| Submission of 2 essaysAttendance at lectures is recommended, but not compulsory. Participation at practice is compulsory. Students must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Attendance at practice classes will be recorded. Being late is counted as an absence. In case of further absences, a medical certificate needs to be presented. Missed practices should be made up for at a later date, being discussed with the lecturer. Active participation is evaluated by the teacher. |

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| **Exam questions/topics:** |
| 1. Nutritional genetics and genomics.2. Epigenetics. 3. Nuclear receptors and signal transduction pathways regulating gene expression.4. Amino acid availability and gene expression regulation.5. Transcriptional regulation of hepatic genes by insulin and glucose.6. PPARs in atherosclerosis, diabetes and metabolic syndrome.7. Nutrition and inflammatory response.8. Genetic polymorphism, nutrition and hypertension.9. Genetic polymorphism, nutrition and cancer. |